By Express Mail # EL331511753US

FORM PTO-1390
(REV 10-94)

U.S DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

DOCKET #: 3245-734PUS

U.S. APPLICATION NO. (If known, see 37 CFR 1.5)
09/509807

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/DE98/02915	**22 September 1998**	**02 October 1997**

TITLE OF INVENTION
Method For Determining And Controlling Material Flux Of Continuous Cast Slabs

APPLICANT(S) FOR DO/EO/US
Wilfried MODROW; Uwe QUITTMANN; Wolfgang SAUER

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. [x]This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. [] This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371
3. [x]This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. [x]A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. [x]A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. [x]is transmitted herewith (required only if not transmitted by the International Bureau).
   b. [] has been transmitted by the International Bureau.
   c. [] is not required, as the application was filed in the United States Receiving Office (RO/US)
6. [x]A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. [x]Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. [] are transmitted herewith (required only if not transmitted by the International Bureau).
   b. [] have been transmitted by the International Bureau.
   c. [] have not been made; however, the time limit for making such amendments has NOT expired.
   d. [x]have not been made and will not be made.
8. [] A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. [x]An unexecuted oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. [] A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. Below concern other document(s) or information included:

11. [] An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. [] An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. [x]A **FIRST** preliminary amendment.
    [] A **SECOND** or **SUBSEQUENT** preliminary amendment.
14. [] A substitute specification.
15. [] A change of power of attorney and/or address letter.
16. [x]Other items or information *(specify):* PCT Publication Sheet, Int'l Preliminary Examination Report, Int'l Search Report, PCT Request,

422 Rec'd PCT/PTO 31 MAR 2000

U.S. APPLICATION NO. (If known, see 37 C.F.R. 1.5) 09/509807	INTERNATIONAL APPLICATION NO. PCT/DE98/02915	ATTORNEY'S DOCKET NUMBER 3245-734PUS

17.[x]The following fees are submitted:

Basic National Fee (37 CFR 1.492(a)(1)-(5)):
Search Report has been prepared by the EPO or JPO **$840.00**
International preliminary examination fee paid to USPTO (37 CFR 1.482)........ **$670.00**
No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)) **$760.00**
Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO **$970.00**
International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) **$96.00**

ENTER APPROPRIATE BASIC FEE AMOUNT =				$	840.00
Surcharge of **$130.00** for furnishing the oath or declaration later than [] 20 [] 30 months from the earliest claimed priority date (37 CFR 1.492(e)).				$	
Claims	Number Filed	Number Extra	Rate		
Total Claims	5 - 20 =	0	x **$18.00**	$	
Independent Claims	1 - 3 =	0	x **$78.00**	$	
Multiple dependent claim(s) (if applicable)			+ **$260.00**	$	
TOTAL OF ABOVE CALCULATIONS =				$	840.00
Reduction of ½ for filing by small entity, if applicable. Verified Small Entity statement must also be filed. (Note 37 CFR 1.9, 1.27, 1.28).				$	
SUBTOTAL =				$	840.00
Processing fee of **$130.00** for furnishing the English translation later than [] 20 [] 30 months from the earliest claimed priority date (37 CFR 1.492(f)). +				$	
TOTAL NATIONAL FEE =				$	840.00
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by the appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property +				$	
TOTAL FEES ENCLOSED					$840.00
				Amount to be refunded:	$
				charged:	$

a. [x] One check(s) in the amount(s) of $ 840.00 to cover the above fees is/are enclosed.
b. [] Please charge my Deposit Account No. 03-2412 in the amount of $_____ to cover the above fees. A duplicate copy of this sheet is enclosed.
c. [x] The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 03-2412. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

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By Express Mail # EL331511753US · March 31, 2000

Attorney Docket # 3245-734PUS

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re National Phase PCT Application of
Wilfried MODROW et al.
International Appln. No.: PCT/DE98/02915
International Filing Date: 22 September 1998
For: Method For Determining And Controlling Material Flux Of Continuous Cast Slabs

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, D.C. 20231
BOX PCT

S I R:

Prior to examination of the above-identified application please amend the application as follows:

In the Specification:

On page 1, line 3, delete "Description" and insert -- BACKGROUND OF THE INVENTION

1. Field of the Invention--;

After line 8, starting its own line add

--2. Description of the Prior Art--;

Line 10, after "with" insert --a-- and after "mill" delete "," and delete "for";

On page 2, after line 19, beginning its own line insert the heading

--SUMMARY OF THE INVENTION--;

Line 26, after "manner" insert --.-- and delete ", in order"

On page 3, line 1, delete "for", change "the" to --The--, delete "values" and insert --amount of heat and the temperature profile--, and change "to" to --may--;

Line 2, after "system" delete --, in order--;

Line 6, delete "to determine";

Line 7, change "slab" to --slab is determined by--;

Line 10, after "slab," insert --calculating--;

Line 13, delete "are calculated";

Line 14, after "and" insert --using--;

Line 16, delete "is used";

On page 4, line 6, delete "there is provision for the" and insert --a--;

Line 7, after "method" change "to" to --may--;

Line 12, after "the" in its second occurrence insert --finite element calculation--;

On page 5, line 3, delete "For the" and insert --The finite element calculation method of the--, after "present invention" delete "," and insert --may comprise--;

Line 9, delete "On line" and insert --However--;

Line 10, after "slow" insert --for use on-line--;

Line 14, after "enough" insert --to use on-line--;

After line 23, starting its own line insert the heading

--DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS--;

Line 25, after "model" delete "," insert --which--; and change --using-- to --uses--;

On page 6, line 5, after "to" delete "make a good estimation, of" and insert --estimate--;

Line 7, after "the" in its third occurrence insert --present--;

Line 8, change "can" to --may--, delete "draw conclusions as to" and insert --determine--;

Line 10, after "bay" delete "," insert --. Furthermore--, and after "to" delete --draw conclusions concerning-- and insert --determine--;

Line 17, change "is able to replace" to --replaces--;

Line 19, after "The" insert --continuous-casting--;

Line 21, after "the" insert --present--;

Line 24, change "invention " to --inventive method--;

On page 7, line 4, delete "aim of an application could be" and insert --inventive method may be used--;

Line 8, delete "by way of" insert --the--, after "example" insert --includes--, after "420" insert --discrete--, after "elements" insert --.-- and delete "are";

Line 9, delete "discretized";

Line 23, delete "is"

Line 24, delete "close to reality" and insert --approximates the actual value--;

On page 9, line 2, after "corresponding" insert --discrete--;

Line 5, after "the" insert --discrete--.

In the Claims:

Please cancel claims 1-4 and insert claims 5-9 as follows:

--5. (New) A method for determining and controlling the material flow of continuous-cast slabs in a continuous casting installation by monitoring and optimizing the temperature on the transport path of the continuous-cast slabs between the continuous-casting installation and a rolling mill, said method comprising the steps of :

a. determining a temperature of the liquid phase of the continuous-cast slab at a mold exit of the continuous-casting installation and physical parameters of the continuous-cast slab;

b. determining an amount of heat and a temperature profile of the continuous-cast slab by calculating the convective mixing of the amount of heat contained in the continuous-cast slab and the time-dependent heat loss from the inhomogenously cooling of the continuous-cast slab, wherein the step of calculating comprises using a mathematical-physical model; and

c. controlling the material flow in the continuous-casting installation via a slab-monitoring system of the continuous-casting installation and using the amount of heat and the temperature profile determined in said step b. as an input to the slab-monitoring system.--

--6. (New) The method of claim 1, wherein in said step b., the substep of calculating comprises using one of a two-dimensional finite element method, a finite difference method, and software using formulas derived from off-line studies to calculate the mathematical-physical model.--

--7. (New) The method of claim 1, wherein said step of determining the physical parameters of the continuous-cast slab comprises determining temperature-dependent material values comprising at least one of density ρ, specific C_p, thermal conductivity λ, and scale properties.--

--8. (New) The method of claim 1, wherein said step a. further comprises determining a surface temperature of the continuous-cast slab, said step c. comprises using a surface temperature of the continuous-cast slab determined in said step a. as an input to the slab monitoring system, and said step c. further comprises automatically controlling the material flow via the slab monitoring system based on the amount of heat and the temperature profile determined in said step b. and the surface temperature of the continuous-cast slab.--

--9. (New) The method of claim 1, wherein said step a. further comprises determining a surface temperature of the continuous-cast slab and said step c. further comprises using the surface temperature of the continuous cast slab measured in said step a. as an input to the slab monitoring system.--

In the Abstract:

Line 1, delete "The invention relates to" and change "a" to --A--;

Line 5, delete ". In this method, to" and insert --includes--;

Delete line 6, in its entirety;

Line 7, delete "the slab starting from the known" and insert --determining the known--;

Line 9, delete "given knowledge of", and after "slab," insert --determining the amount of heat and the temperature profile of the continuous-cast slabs by calculating--;

Line 12, delete "are";

Line 13, delete "calculated by means of" insert --using--, after "and" delete "the" and insert --using the--;

Line 15, delete "is used".

REMARKS

This preliminary amendment is presented to place the application in proper form for examination. No new matter has been added. Early examination and favorable consideration of the above-identified application is earnestly solicited.

By Express Mail # EL331511753US · March 31, 2000

Any additional fees or charges required at this time in connection with the application may be charged to our Patent and Trademark Office Deposit Account No. 03-2412.

Respectfully submitted,
COHEN, PONTANI, LIEBERMAN & PAVANE

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Method for determining and controlling the material flow of continuous-cast slabs

Description

The invention relates to a method for determining and controlling the material flow of continuous-cast slabs, in particular steel slabs, by monitoring and optimizing the temperature on their transport path between the continuous-casting installation and the rolling mill.

For the operator of a continuous-casting installation with connected rolling mill, and for projecting slab continuous-casting finishing bays as a link between the continuous-casting installation and the rolling mill, it is becoming increasingly important to know the heat content which is present in the slab which has just been cast or is being temporarily stored, in order to bring the slab into a material flow which corresponds to the heat content still present therein in an economical optimum manner. Since a slab which has just been cast has an inhomogeneous temperature profile which, over a prolonged period, strives to achieve a more homogenous temperature profile, it is not possible to draw conclusions about the mean slab temperature using measurable surface temperatures. Therefore, it is also impossible to be certain of the slab temperature profile

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after a certain time, for example in order to bring the slab to an optimum, homogenous rolling temperature via a reheating fixture. Finally, the solidified slab which leaves the caster passes through different transport and processing paths, which each lead to different slab temperature profiles. Differences in the temperature profile arise depending on whether the slab is transported on a roller table with or without thermal insulation, whether one or more slabs are stored in the stack, whether the slabs are stored in an open slab yard or in an open or closed holding pit. Different temperature profiles also result for slabs which have undergone accelerated cooling in a water immersion basin compared to those which have undergone slower cooling in a water-spraying installation. It is therefore clear that it is desirable to find and be aware of the cooling profile of the various slabs, in order to use this knowledge in a targeted manner for material monitoring and controlling the material flow, which were hitherto carried out predominantly on the basis of experience and tests.

In view of the above problems, the object of the present invention is to find a method for determining and controlling the material flow of continuous-cast slabs, in particular steel slabs, which enables the amount of heat and the temperature profile of a continuous-cast slab on its path between the continuous-casting installation and the rolling mill to be determined and used in a targeted manner, in order

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for the values found to be used in an existing slab-monitoring system, in order to obtain a material flow which is optimum in terms of energy, i.e. is economical and safe.

To achieve the object, it is proposed, according to the invention, that to determine the amount of heat and the temperature profile of the slab, starting from the known temperature of the liquid phase at the mold exit of the continuous-casting installation and given knowledge of the physical parameters of the slab, the convective mixing of the amount of heat contained in the slab and the time-dependent heat loss from the inhomogeneously cooling slab to the surrounding medium are calculated by means of a mathematical-physical model, and the result of the calculation, if appropriate together with the measured surface temperature of the slab, is used to control the material flow in an existing slab-monitoring system.

The proposal of the invention makes it possible to guide a slab in a controlled manner through the various material flows, such as warm charge rolling, hot charge rolling, cold charge rolling or hot direct rolling, from the continuous-casting installation into the rolling mill. It is possible both to find the cooling profile of various slabs in the stack and to determine the profile of cooling at the surface of various slabs, in order to draw a conclusion concerning the temperature in the interior of the slab using

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control measurements. The calculated values and additional production data of the installation can be used, for example, to determine the size of the holding pit and, in operation, to predict hot batches at different mean temperatures.

In a preferred configuration of the method according to the invention, there is provision for the two-dimensional finite element method to be used to calculate the mathematical-physical model. Finite element calculation methods enable a very wide range of operations to be simulated, thus assisting with design developments, handling operations, sales and, in the present case, also the future plant operator. In the design phase, the method is frequently used to reveal and minimize possible risks through structural mechanics analyses. It can be used to carry out deformation and stress analyses, temperature calculations, thermomechanical simulations and also to determine eigenfrequencies and eigenforms, with the aim of structural optimization. Simulations based on finite element calculations are often demanded by plant operators as early as the project phase and are frequently included in the supply contract of the plant as a fixed component of the contract.

Calculations using the finite element method are also carried out during the development of mathematical-physical models which have to provide accurate results on-line within

a very short time, predominantly parameter studies, from the results of which analytic formulae are then derived.

For the present invention, the two-dimensional finite element method, the finite difference method or software using formulae derived from off-line studies are used to calculate the mathematical-physical model.

A universal, commercially available finite element package can be used in off-line studies to implement the method. On line, this package is probably too large and too slow. Therefore, it is appropriate to use, i.e. program, a method (this may also be a finite element method or the finite difference method) which is specifically adapted to the slab geometry (rectangular) and is therefore quick enough. The on-line method can be checked using the off-line finite element package.

The physical parameters of the slab used are preferably the temperature-dependent material values density ρ, the specific heat c_ρ, the thermal conductivity λ and scale properties.

According to the invention, to optimize the method, the result of the calculation and the measured surface temperature of the slab are linked to automation of the material flow in the slab-monitoring system.

The invention advantageously makes it possible, by means of the mathematical-physical model, preferably using a finite element simulation or finite difference method, to

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determine the temperature profile of slabs and stacks of slabs of different dimensions under specific cooling conditions. Through evaluation of the profiles of the mean slab temperature and selected surface temperatures over time, it is subsequently possible to make a good estimation of the mean slab temperatures by measuring the surface temperature. For example, the result of the method according to the invention can be used to draw conclusions as to how many hours a fixed mean slab temperature is maintained in the finishing bay; it is possible to draw conclusions concerning the entire temperature spectrum in the slab-monitoring system. It has emerged that the method according to the invention and the above-described calculation method are very flexible in use and are suitable for achieving the object of the invention, i.e. that of enabling economical and reliable material flow between the continuous-casting installation and the rolling mill. The invention is able to replace the previous slab control method which was based on experience and empirical values. The installations no longer have to be overdimensioned for safety reasons, because with the method according to the invention it is now possible to determine and control the actual conditions for the material flow between continuous-casting installation and rolling mill.

The invention is easiest to explain with reference to a practical example. In the example, it is assumed that a plurality of continuous-cast slabs are stored in a stack in

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an open holding pit. The mean cooling profile of the various slabs in the stack is to be determined, as is the profile of cooling at the surfaces of various slabs in the stack. The aim of an application could be to determine the size of a holding pit or to predict hot batches of slabs at different mean temperatures during ongoing production.

Working on the basis of a model as described above, by way of example thirteen slabs each with 420 elements are discretized. It is sufficient to model one half of a slab given symmetrical boundary conditions and, for example, to generate the finite element network in such a way that the mean temperature and the time-dependent control of the stacking operation can subsequently be determined with ease.

The simulation can be divided up as follows:

1. Monitoring of the temperature of the slab cross section as it passes through the caster, corresponding to the starting temperature profile for each individual slab at the start of the stack.
2. Simulation of the stack of the individual slabs.
3. Simulation of the cooling of the stack of slabs.

In the first substep, the solidification of the slab in the caster is simulated in order to generate an entry temperature profile of the slabs in the holding pit which is close to reality. The material density, specific heat and thermal conductivity are temperature-dependent.

In the liquid phase, there is also convective heat exchange, but this was not modeled. In order nevertheless to simulate the temperature homogenization on the basis of the convective mixing, instead the thermal conductivity was increased by a factor of 100 compared to the solid phase. The various water cooling operations in the areas of the primary and secondary cooling zones represent important boundary conditions. The temperature range of possible surface temperatures is divided into sections of various heat transfer types (stable film evaporation, unstable area, burn-out point, etc.) on the basis of a heat transfer model, since different approaches apply with regard to the heat transfer coefficient for these areas. In some of these areas, the heat transfer coefficient is also dependent on the materials value of the surface of the cooling body, this applying, in the present case, in particular to highly oxidized surfaces, for which the materials values of scale are to be used.

The simulation of the stack of slabs begins with the introduction of the first slab into the holding pit. Thereafter, every 60 seconds the next slab is stacked on top of the previous slab. The stacking operation ends when a cold slab is laid on top of the twelve slabs which have hitherto been stacked. The inherent weight of the cold slab reduces the curvature of the top hot slab.

After the first slab has been introduced into the store, the corresponding elements of this slab are activated, and the finite element simulation for this slab takes place as early as in the holding pit. The second slab follows, and the elements of slab two are activated. This procedure continues in a similar manner until the final, cold slab is introduced into the store. The simulation of the entire stack of slabs in the holding pit then begins. Here as well, the heat transfer coefficients between the slab surfaces and the environment form significant boundary conditions. With the exception of the bottom support surface, heat transfer through air convection plus radiation is assumed for all surfaces of the stack of slabs.

The air convection is calculated using specific functions, since different heat transfer coefficients apply for the horizontal and vertical surfaces. At high temperatures, these coefficients are still low compared to the heat transfer coefficients of radiation, but at low temperatures the convection coefficients become dominant. Furthermore, the ambient temperature throughout the wider environment of the hall and the walls of the holding pit form part of the calculation. However, in a representative stack, these parameters can only be seen in a particular part of the solid angle, while in other parts of the solid angle there are adjacent stacks, which are at a similar temperature.

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The bottom horizontal surface of the stack is in contact with the pit floor. The pit floor itself could be included in the finite element calculation, but in a simplified version it is also possible to model the pit floor as a semi-infinite body which remains constantly at its starting temperature, at which there is then a time-dependent heat transfer coefficient.

For given slab dimensions, it is then possible to determine the temperature profile over the cross section of the slab or the stack of slabs. To be reintegrated into the material flow between caster and rolling mill, the mean temperature of a steel slab should lie between 500 and 600°C. At the start of cooling, the first slab still has the temperature profile corresponding to when it leaves the caster. At the end of the stacking operation, it is found that there is a more homogenous temperature distribution in the stack if the floor is appropriately well insulated. As a result of the cold slab being laid on top, the top slab in the stack loses a relatively large amount of heat in the first hour, and the bottom slab in the stack cools rapidly during a short initial period, until the floor acts as an insulator.

By linking a physical-mathematical model to the automation of a standard slab material flow, the method according to the invention makes it possible to control the individual slabs between continuous-casting installation and

rolling mill in an economical and reliable manner. By carrying out control measurements on the surface of the slabs, including the values obtained through the calculation model, it is possible to draw conclusions as to the amount of heat and the temperature profile of the slab in a simple manner, provided that the appropriate boundary conditions are included. In this way it is possible to determine, at any location between continuous-casting installation and rolling mill and, in particular, in storage yards, how much heat is associated with the particular slab and what level of energy has to be supplied or dissipated in order to reach the temperature profiles which are optimum for the further process. The invention provides a design engineer with a means of designing the installation optimally, so that it is economical to produce and run.

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Patent Claims

1. A method for determining and controlling the material flow of continuous-cast slabs, in particular steel slabs, by monitoring and optimizing the temperature on their transport path between the continuous-casting installation and the rolling mill, wherein, to determine the amount of heat and the temperature profile of the slab, starting from the known temperature of the liquid phase at the mold exit of the continuous-casting installation and given knowledge of the physical parameters of the slab, the convective mixing of the amount of heat contained in the slab and the time-dependent heat loss from the inhomogeneously cooling slab to the surrounding medium are calculated by means of a mathematical-physical model, and the result of the calculation, if appropriate together with the measured surface temperature of the slab, is used to control the material flow in an existing slab-monitoring system.

2. The method for determining and controlling the material flow of continuous-cast slabs as claimed in claim 1, wherein the two-dimensional finite element method, the finite difference method or software using formulae derived from off-line studies are used to calculate the mathematical-physical model.

3. The method for determining and controlling the material flow of continuous-cast slabs as claimed in claims 1

and 2, wherein the physical parameters of the slab used are the temperature-dependent materials values, such as density ρ, the specific heat c_{ρ}, the thermal conductivity λ and scale properties.

4. The method for determining and controlling the material flow of continuous-cast slabs as claimed in claims 1 to 3, wherein the result of the calculation and the measured surface temperature of the slab are linked to automation of the material flow in the slab-monitoring system.

Abstract

The invention relates to a method for determining and controlling the material flow of continuous-cast slabs, in particular steel slabs, by monitoring and optimizing the temperature on their transport path between the continuous-casting installation and the rolling mill. In this method, to determine the amount of heat and the temperature profile of the slab, starting from the known temperature of the liquid phase at the mold exit of the continuous-casting installation and given knowledge of the physical parameters of the slab, the convective mixing of the amount of heat contained in the slab and the time-dependent heat loss from the inhomogeneously cooling slab to the surrounding medium are calculated by means of a mathematical-physical model, and the result of the calculation, if appropriate together with the measured surface temperature of the slab, is used to control the material flow in an existing slab-monitoring system.

COMBINED DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY Includes Reference to PCT International Applications	Attorney's Docket No.3245-734PUS

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

METHOD FOR DETERMINING AND CONTROLLING MATERIAL FLUX OF CONTINUOUS CAST SLABS

the specification of which (check only one item below)

[X] is attached hereto

[] was filed as United States application

Serial No. _

on _

and was amended

on _ (if applicable).

[X] was filed as PCT international application

Number PCT/DE98/02915

on September 22, 1998

and was amended under PCT Article 19

on _ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the patentability of the application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed.

PRIOR FOREIGN/PCT APPLICATIONS AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. 119:

Country (if PCT, indicate "PCT")	Application Number	Date of Filing (day, month, year)	Priority Claimed Under 35 U.S.C. 119	
Germany	197 44 815.1	October 02, 1997	[X] YES	[] NO
PCT	PCT/DE98/02915	September 22, 1998	[X] YES	[] NO
			[] YES	[] NO
			[] YES	[] NO
			[] YES	[] NO
			[] YES	[] NO
			[] YES	[] NO

Combined Declaration for Patent Application and Power of Attorney (Continued) (Includes Reference to PCT International Applications)	Attorney's Docket No. 3245-734PUS

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) or PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application:

PRIOR U.S. APPLICATIONS OR PCT INTERNATIONAL APPLICATIONS DESIGNATING THE U.S. FOR BENEFIT UNDER 35 U.S.C. 120:

U.S. APPLICATIONS			STATUS (*check one*)		
U.S. APPLICATION NUMBER		U.S. FILING DATE	PATENTED	PENDING	ABANDONED
PCT APPLICATIONS DESIGNATING THE U.S.					
PCT APPLICATION NO.	PCT FILING DATE	U.S. SERIAL NUMBERS ASSIGNED (*if any*)			
PCT/DE98/02915	September 22, 1998			X	

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith (*List name and registration number*)

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Combined Declaration for Patent Application and Power of Attorney (Continued) (Includes Reference to PCT International Applications)				Attorney's Docket No. 3245-734PUS
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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under §1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

SIGNATURE OF INVENTOR 201	SIGNATURE OF INVENTOR 202	SIGNATURE OF INVENTOR 203
DATE 03, 30, 2000	DATE 04/12/2000	DATE 03/30/2000

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